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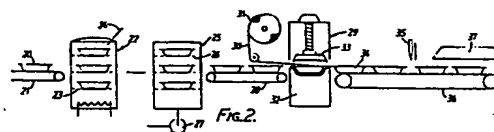
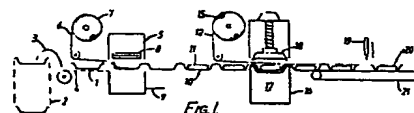
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⑤④ Improvements in or relating to packaging.

⑤⑦ A process is disclosed for packaging a food product in a container formed of or lined with a heat-resistant thermoplastics. The container is closed by sealing to the container a lidding material which is permeable to water and gas but impermeable to bacteria, such as so-called "medical paper". The food product can then be sterilized or pasteurised by heat-treatment and the lidding material is then covered by a barrier layer which is impermeable to moisture or permits controlled moisture permeability. The lidding material and barrier material are applied by heat-sealing techniques and the final package may be irradiated to sterilize the head space between the lidding and barrier layers.



Description

IMPROVEMENTS IN OR RELATING TO PACKAGING

This invention relates to a process for packaging food products, in which process the food products can be subjected to a sterilizing or pasteurizing treatment or even a cooking treatment.

Simple packages of food products which can be sterilized by heat-treatment with steam in pressure vessels - so-called retortable packages - have hitherto been in the form of rigid inherently mechanically stable packages, such as cans or glass containers with rigid lids. These packages are either filled with hot food product or treated with steam at the time of closure. The steam treatment involves the use of superatmospheric pressure in the region of 15 p.s.i. (1.05 kg/cm²) and the packages undergo thermal shock when the pressure of treatment is relieved and/or when subjected to cooling. The thermal shock is contained by flexing of the ends of the cans or the lids of the jars or, in the case where the products are vacuum packed, is negated by the effect of the vacuum packaging process.

Complex retortable packages are those which require an additional overpressure during the steam treatment to prevent the packages from bursting, such overpressure being supplied by compressed air. Again problems of thermal shock are frequently encountered when the pressure is relieved and/or the packages are cooled.

In addition to the above, simple closed packages of bakery products, such as cake and bread, which can be pasteurized require unsealed channels to be provided to permit the release of pressure and steam when the packages are subjected to pasteurization under heat. After cooling, these channels must be sealed in order to prevent recontamination of the contents of the package, since there is clearly a considerable risk of recontamination from air sucked back into the package. It is also difficult to attain a full pressure of steam in the package, approaching boiling point, without seal or package rupture.

A need exists for a process to provide packages which are free from heat-sensitive vegetative forms of micro-organisms, and specifically moulds, for containing moist bakery products, such as those of high water activity, for example bread and muffins.

It is an object of the present invention to provide a package in which the above problems are reduced or solved, and which is a retortable or simple closed package in which the contents can be subject to a heat-treatment.

According to the present invention there is provided a process for packaging a food product, comprising the steps of placing the food product in a container formed of a moulded fibrous material and lined with a thermoplastic layer or formed of heat-resistant plastics material, heat sealing to the edges of the container a bacteria-impermeable and water- and gas-permeable lidding layer under conditions such that the material of the thermoplastic layer extends through the lidding layer to provide a hermetic seal, heat-treating the package to sterilize

or pasteurize the contents thereof, cooling and drying the package, heat-sealing to the lidding material a barrier layer which is moisture impermeable or which permits controlled moisture permeability and, optionally, subjecting the completed package to irradiation sterilization. The irradiation sterilization may be specifically required to sterilize the head space between the lidding layer and the barrier layer, especially for products which are very moist and have a high active water content. However, in many bakery products, the final water activity (% equilibrium relative humidity) is low enough to prevent mould growth in the space between the lidding layer and the barrier layer.

The heat-treatment may take the form of a treatment with steam in an autoclave or like vessel for the purpose of subjecting the contents of the package to a steam-sterilization treatment. Alternatively, the package may be heated, preferably by dielectric heating, to generate within the package steam for pasteurizing or sterilizing the contents thereof.

The containers which are used in the present process are preferably formed of porous fibrous material, such as moulded fibre pulp, paper, cardboard or fibre board made in conventional manner by moulding fibres deposited by paper-making techniques. Alternatively, the containers may be made from bonded wood chips or bonded fibre material provided that the bonding material is capable of withstanding the heat-treatment conditions involved in sterilizing or pasteurizing. The containers may also be made of foamed plastics or fibrous structures of plastics which may contain fillers and which are also capable of withstanding the sterilizing or pasteurizing conditions or they may be made of cast or moulded plastics capable of withstanding the sterilizing or pasteurizing conditions, such as nylon, polyethylene terephthalate or polymethyl pentene, the latter being particularly useful if transparent packages are required.

Those containers which are made of porous fibrous material are lined with a thermoplastic material which is capable of melting under heat and pressure to bond to the lidding layer but which is also capable of withstanding the heat-treatment conditions. Suitable lining materials include nylon, polyesters, polypropylene and certain other polyolefins and other polymeric materials. A preferred lining material is an ionomeric polymer which is a polymer in which ionised carboxyl groups create ionic crosslinks in the molecular structure, which links are reversibly broken at melt temperatures. Such a polymer will hereinafter be referred to as "ionomer" for convenience and a preferred ionomer is that sold under the registered Trade Mark "SURLYN".

The lidding material is one which is permeable to gas and moisture but which has the ability to exclude micro-organisms. The preferred material is so-called "medical paper" sold under the Trade Mark "STER-ISHEET" in which the fibres are laid so as to prevent

the passage of bacteria and other micro-organisms therethrough. Instead of medical paper, it is possible to use a microporous polypropylene film, such as that sold under the registered Trade Mark "VAL-MIC".

After the food product to be packaged has been placed in the container, the package is heat-sealed using a shaped support and heating tool under conditions such that the thermoplastics lining melts and flows through the lidding material at the edges to provide a hermetic seal and one through which wicking of moisture cannot occur. Suitable heat-sealing temperatures are 170°C. for ionomer and polypropylene linings and 220-230°C for nylon and polyester linings.

The packages are then subjected to heat-treatment. In one embodiment of the present process, the packages are placed in an autoclave or pressure vessel and subjected to steam sterilization for an appropriate time/temperature combination. In accordance with the food regulations this treatment may be from F1 conditions, namely a steam pressure of 15 p.s.i. (1.05 kg/cm²) for 15 minutes to F4 conditions, namely a steam pressure of 15 p.s.i. (1.05 kg/cm²) for 45 minutes, the temperature in each case being 121.5°C, in accordance with the requirements of the contents of the package or the microbiological status of the contents. During sterilization of the package distortion thereof may occur and the lidding material may form a dome to the package.

In another embodiment of the present process, the packages are heated by dielectric energy in a microwave oven or in a microwave or radio frequency tunnel to generate steam within the package so as to raise the temperature of the atmosphere in the package to a desired value between 65° and 100°C. The grade, thickness, substance and physical characteristics of the lidding material and particularly its permeability to gas and steam, will be such that the correct and desired amount of moisture will be retained in the product at the end of the heating cycle. In addition, the degree of pressure generated in the package by the steam which is formed during the heating step and which may result in distortion of the lidding material to form a dome, and the temperature can be suitably selected. The strength of the seal between the lidding material and the tray or the polymer lining of the tray, and the elastic nature of the tray and of the moist lidding paper permit a degree of overpressure to be provided by the internal generation of steam in the package without rupture or deformation. An "overpressure" develops, for example, in a 700 watt microwave oven with a small moist sliced loaf within 30 to 40 seconds. A short time at a temperature above 70°C is sufficient to kill moulds and their spores. Some adjustment of the moisture regime may be needed to allow for the loss of water as steam through the lidding material.

After the sterilization or pasteurization heat-treatment the package is cooled and any steam present in the package can flow out through the lidding material, while the elasticity and flexibility of the container and its lining allow the relief of pressure to

proceed naturally and with no untoward distortion, any distortion which may have occurred during the heat-treatment correcting itself naturally. The packages can then be allowed to dry in air or be force dried, preferably under sterile conditions, the lidding material preventing the ingress of micro-organisms, and, when dry, the packages are heat sealed with a suitable moisture-proof barrier film which may be a composite polyester/polyvinylidene chloride/polypropylene film. Again, it is important to provide a hermetic seal at the edge of the package to prevent wicking of moisture between the barrier film and the lidding material.

In order to prevent the growth of moulds, the hyphae of certain of which are capable of growth through cellulosic fibrous materials and are thus able to pass through the lidding material, the packages may be finally subjected to an irradiation sterilization, preferably by use of ultra-violet light of appropriate wave length to kill micro-organisms and mould spores which may be present in the head space between the lidding material and the barrier film. This is particularly important for food products which have a high water content and those where the growth of moulds may be a problem.

The resulting pasteurized packages can be stored at ambient temperatures for extended periods of time and are microbiologically stable, the storage life depending upon the gas permeability of the lining to the container and the barrier film.

In order to enable the invention to be more readily understood, reference will now be made to the accompanying drawings which illustrate diagrammatically and by way of example an embodiment thereof, and in which,

FIGURE 1 shows part of plant for packaging food products,

FIGURE 2 shows a further part of the plant including a sterilizing step,

FIGURE 3 shows an alternative part of the plant including a pasteurizing step,

FIGURE 4 is a partly exploded section through a package produced by the plant shown in Figures 1 and 2 or Figures 1 and 3,

FIGURE 5 shows a continuous overhead sealer, and

FIGURE 6 is a perspective view of a wrapped package.

Referring now to Figure 1 there is shown plant for producing packages of a food product to be sterilized or pasteurized. Preformed containers in the form of flanged trays 1 of porous fibre material, e.g. moulded fibre trays are taken from a stock 2 of trays by destacking apparatus indicated by arrow 3 and placed in rows across a conveyor 4 so as to form a closely spaced array of trays on the conveyor. The trays 1 are fed to a thermo-forming station 5. A reel 7 of ionomer film 6 in which is sandwiched a barrier of polyvinylidene chloride (not shown in Figure 1) and which has a thickness of 100 microns is mounted above the conveyor 4 and the film is united with the trays at the thermo-forming station 5 so as to line the trays with the film and unite the trays. The film is coherently bonded to the trays by being heated by a heater 8 and by being drawn downwardly by a

vacuum applied at a vacuum outlet 9.

After leaving the thermo-forming station, the trays are passed to a loading station 10 where they are filled with the food product 11 to be packaged. A lidding material 12 in the form of a web of medical paper sold under the Trade Mark "STERISHEET" A5/43 and having a base weight of 59 g/m² is unwound from a reel 15 located above the flow path of the trays and brought to cover them. The two webs are then combined in a heat-sealing machine 16 using a shaped supporting tool 17 shaped to receive the trays and an overhead sealing plate 18. The heat-sealing is effected under pressure at a temperature of 170°C for a time sufficient to ensure that the ionomer lining of the tray melts sufficiently to flow through the paper to provide a hermetic seal at the flanges of the tray.

The filled trays leaving the heat-sealing machine are separated by a knife 19 into individual packages 20 which are passed to sterilization in the part of the plant shown in Figure 2.

Referring now to Figure 2, the packages 20 separated by the knife 19 are fed on a conveyor 21 to an autoclave 22 where they are stacked on supports 23 and subjected to a steam sterilization treatment at a temperature of 121.5°C, under a pressure of 15 p.s.i. (1.05 kg/cm²) for 15 minutes. At the end of this period, the autoclave is cooled by the injection of cold water through a pipe 24. After cooling, the packages are stacked in a drying tower 25 on supports 26 and are dried by blowing air over them using a blower 27.

When the packages are dry, they are passed by a conveyor 28 to a second heat-sealing machine 29. A barrier film 30 in the form of a web of a composite material 43 microns thick is unwound from a reel 31 located above the flow path of the packages and brought to cover them. The barrier film comprises an inner layer of ionomer, a middle layer of polyvinylidene chloride and an outer layer of polypropylene. The barrier film is then heat sealed by its ionomer layer to the edges of the packages in the heat-sealing machine using a shaped supporting tool 32 and an overhead sealing plate 33. The heat sealing is effected under pressure at a temperature of 170°C for a time sufficient to ensure that a hermetic seal is provided at the edge of the package so that no wicking of moisture into the region between the medical paper and the barrier film can occur.

The joined packages 34 are separated by a further knife 35 and conveyed by a conveyor 36 beneath an ultra-violet irradiator 37. The sterilized packages are then delivered to storage or for sale. If desired or more convenient, the packages may be irradiated before they are separated.

In an alternative embodiment, the filled trays leaving the heat-sealing machine and separated by a knife 19 into individual packages 20 are passed from the part of the plant shown in Figure 1 to pasteurization in the part of the plant shown in Figure 3.

Referring now to Figure 3, the packages 20 are fed on the conveyor 21 to a microwave or radio frequency tunnel 40 where they are heated in a dielectric field between an electrode 41 connected to a

microwave or radio frequency source 42 and an electrode 43 connected to earth. As a result of the heating in the tunnel 40, steam is generated in the packages 20 and the pressure of the steam may cause the lidding of medical paper to form a dome over each package. Steam escapes through the dome but as indicated above, the lidding material and the temperature of heating are so chosen as to ensure that the generation of steam does not rupture the package or the seal and that the contents of the package reach a temperature of from 65 to 100°C to ensure that the contents of the package are properly pasteurised.

After leaving the tunnel 40, the packages pass to a cooling station 44, indicated diagrammatically, where cooling air 45, preferably sterile air, is blown over them to cool them and allow the dome of lidding material to revert to its normal flat condition.

When the packages are cool, they are passed by the conveyor 21 to the second heat-sealing machine 29 where they are covered by the barrier film 30 in the manner described with reference to Figure 2.

Figure 4 shows the finished package in more detail with the moulded fibre tray 1 lined with the lining 6 comprising an inner layer 46 of ionomer, an outer layer 47 of ionomer and a gas-impermeable layer 48 of polyvinylidene chloride sandwiched between the two ionomer layers. Figure 4 also shows the package covered with the lid of medical paper 12 covered by the barrier film 30 which comprises an inner layer 49 of ionomer heat-sealed at the edges to the medical paper, an intermediate gas-impermeable layer 50 of polyvinylidene chloride and an outer protective layer 51 of polyester.

In an extension of the present process, the packages 20 may contain a pie mixture and the packages after the heat-treatment but before the application of the barrier film, are subjected to a baking process in an oven when the normal crust is formed and development of the desired colour and texture takes place. In addition, where appropriate, this also has the effect of drying out the fibre tray if it should still contain any moisture. This extension of the process permits sterile pies to be produced and the barrier film will be one which is chosen to permit moisture vapour loss at a controlled rate to retain the desired texture of the crust. Suitable materials for the barrier film include polyvinylalcohol and polymers thereof, plasticised polyvinyl chloride and various coated regenerated cellulose films. The package is finally submitted to ultraviolet irradiation.

In this extension of the process or in any case in which it is necessary to heat the product in a conventional oven up to a temperature, say of 240°C, it is necessary that the tray or lining material of the tray be a polymer or polymeric system which is resistant to the oven heating but which also has the capability of bonding into the fibrous structure of the lidding material. Likewise, the barrier layer 50 may be of ethylene-vinyl alcohol copolymer to resist higher temperatures, while the inner layer 49 should be temperature resistant.

In the case of pork pies and similar products in which jelly is incorporated, the jelly in sterile and liquified form could be injected into the pie and

through the lidding material after the pie has been baked and before the barrier film is applied. The ability to provide a packaged pie in a package which permits controlled moisture loss (breathability) and in which the growth of moulds is inhibited is a major commercial advantage.

It will be appreciated that many other variations in the process and packages may be made. Thus, for example, the food product to be packaged may be placed at the loading station 10 into prelined containers produced elsewhere and fed to the loading station by a destacker mechanism.

The package itself and the components thereof are, of course, chosen to suit the various processing regimes, e.g. sterilizing, pasteurizing, baking, etc., to which the package is to be subjected, and the various materials will preferably be chosen to be compatible with one another. Thus, if the lidding material is of microporous polypropylene rather than medical paper, it is desirable for the outer layer of the lining 6 to be also of polypropylene.

It will be appreciated that many modifications and variations of the described packaging process may be made. In one such modification, for example, the food product to be packaged may be placed hot into the trays directly after leaving an oven in which it has been cooked. The trays are then immediately covered with a lidding of medical paper. In this case the heat retained in the product may be such that only a limited amount of heating is required from the dielectric heating in order to achieve the required pasteurising temperatures of above 70°C., for the required time.

In a further extension of the present process, the heat-treated, cooled and dried package, after baking the contents if desired, is flow-wrapped to form a so-called pillow pack by covering the package in a tube of the barrier layer material, sealing the ends of the tube and then sealing the barrier layer to the edges of the container. The final package then has the form of a bag enveloping the container which is heat-sealed at its edges to the bag.

This extension of the process will now be illustrated with reference to Figure 5 in which the packages 20 leaving the drying tower 25 shown in Figure 2 or the radiant heater 40 shown in Figure 3, optionally after the contents have been baked, are passed to a wrapping machine (not shown) in which they are each enveloped in a bag of the barrier film material, either by being overwrapped with the material, which is then heat-sealed along three sides to form a closed bag 53 or by being placed in a tube of the material which is sealed at its ends also to form a closed bag 53.

The bags 53, containing the packages 20 are then fed on a conveyor 54 to a continuous overhead pressure sealer comprising an endless belt 55 passing over end rollers 56 which are mounted on supports 57 and which are moved up and down by means (not shown). Within the endless belt 55 is a hot box 58 and a cold box 59. The enveloped packages are moved on the conveyor 54 so that each in turn lies below the hot box 58 and then the cold box 59. When the package lies below the hot box the sealer is lowered to contact the package so

that the barrier film in contact with the edges of the package 20 is heat-sealed thereto under a pressure and temperature sufficient to ensure that a hermetic seal is provided at the edge of the package so that no wicking of moisture into the region between the medical paper and the barrier film could occur. The sealer is then raised and the package is passed to lie beneath the cold box to cool the seal, whereafter the package is conveyed to an ultra-violet irradiator.

Figure 6 shows the enveloped package with the barrier film in the form of a tube 60 heat-sealed at its ends 61 and heat-sealed at 62 to the edges of the package 20.

Claims

1. A process for packaging a food product, comprising the steps of placing the food product in a container, sealing a lidding layer to the container, heat-treating the resulting package, and subsequently cooling the package,

characterised in that the container (1) is formed of a moulded fibrous material and is lined with a heat-resistant thermoplastic layer (6) or is formed of heat-resistant thermoplastic material, that the lidding layer (12) is of bacteria-impermeable but water- and gas-permeable material and is heat-sealed to the edges of the container under conditions such that the material of the thermoplastic layer (6) or of the tray extends through the lidding layer to provide a hermetic seal, and that after the heat-treatment and cooling a barrier layer (30) which is moisture impermeable or which permits controlled moisture permeability is heat-sealed to the lidding material at the edges of the container.

2. A process as claimed in Claim 1, wherein the package is subjected to irradiation sterilization to sterilize the head space between the lidding layer and the barrier layer.

3. A process as claimed in Claim 1 or 2, wherein the lidding layer is medical paper in which the fibres are laid so as to prevent the passage of bacteria and other micro-organisms therethrough.

4. A process as claimed in Claim 1 or 2, wherein the lidding layer is a microporous polypropylene film and wherein the container (1) or the lining (6) thereof is of polypropylene.

5. A process as claimed in any one of Claims 1 to 4, wherein the heat-treatment comprises steam sterilization in an autoclave (22) or like vessel, preferably at a steam pressure of 1.05 kg/cm² for a period of from 15 to 45 minutes.

6. A process as claimed in any one of Claims 1 to 4, wherein the heat-treatment comprises heating the package by dielectric energy in a microwave oven or a microwave or radio frequency tunnel so as to raise the temperature of the atmosphere in the package to from 65 to 100°C.

7. A process as claimed in any one of Claims 1 to 6, wherein the container is made of nylon, polyethylene terephthalate or polymethylpentene or is made of a porous, fibrous material lined with nylon a polyester, polypropylene or an ionomeric polymer.

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8. A process as claimed in any one of Claims 1 to 7, wherein the barrier layer comprises polyvinyl alcohol, a polyvinylalcohol polymer, an ethylene-vinyl acetate copolymer, plasticised polyvinyl chloride or a regenerated cellulose film.

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9. A process as claimed in anyone of Claims 1 to 8, wherein, after heat-treatment and cooling, the package is placed in a closed bag of the barrier layer material which is then heat-sealed to the lidding material.

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10. A process as claimed in any one of Claims 1 to 9, wherein, after the heat-treatment, the package is subjected to a baking process in an oven to cook the contents thereof.

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11. A package containing a food product prepared by the process claimed in any preceding claim.

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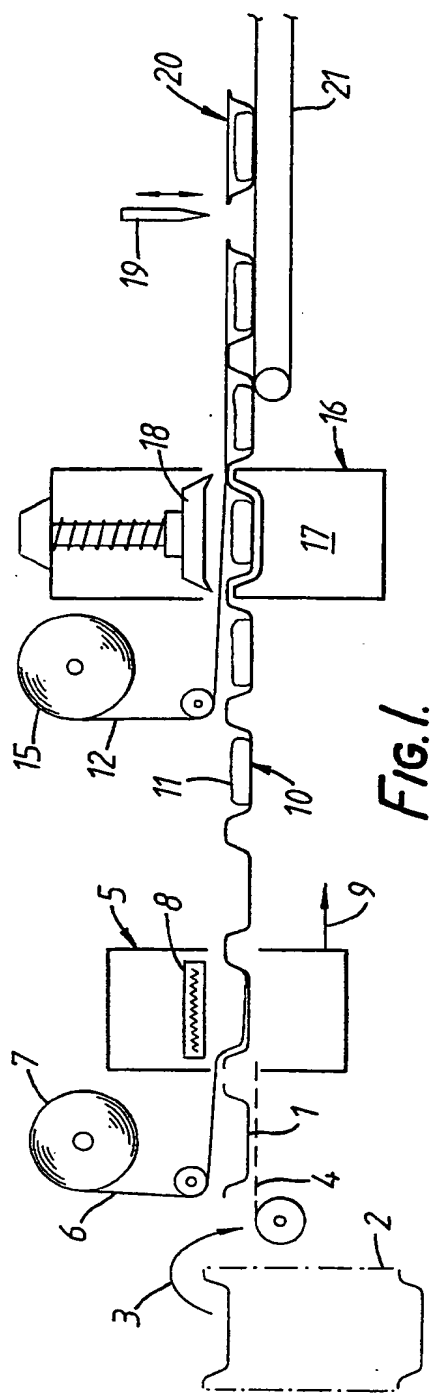


FIG. 1.

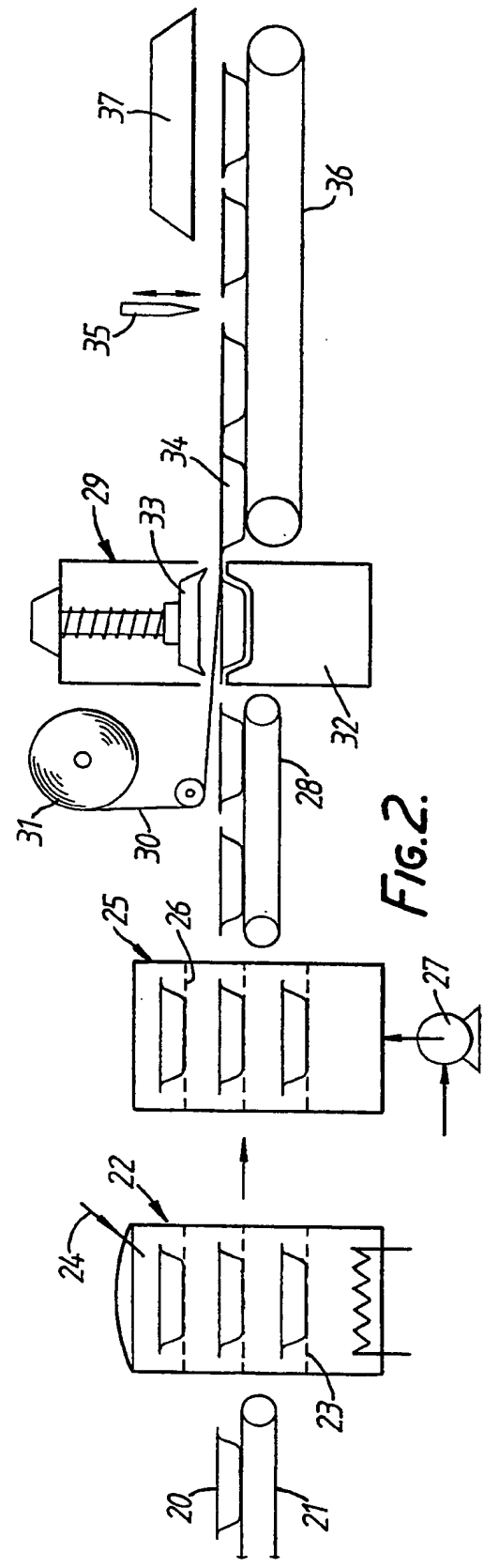
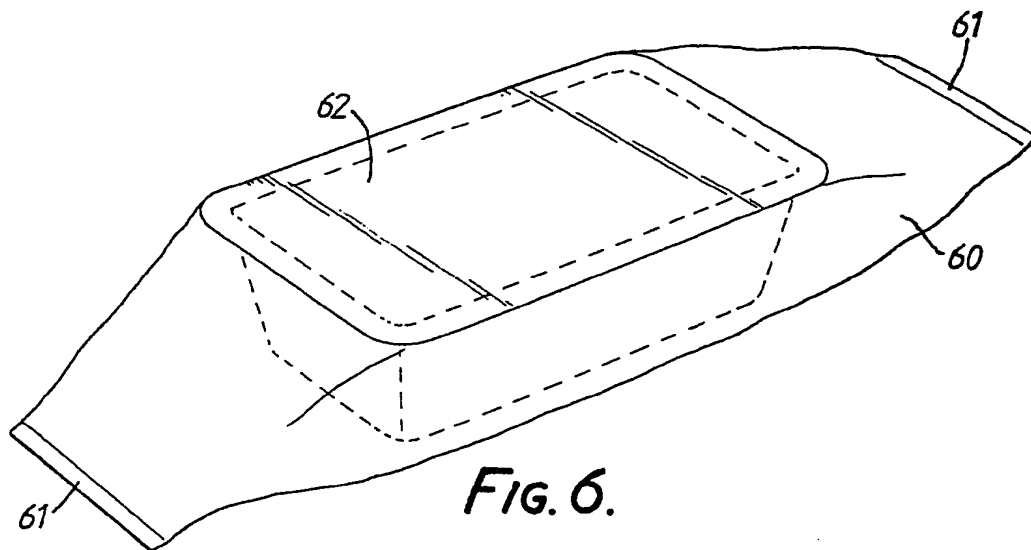
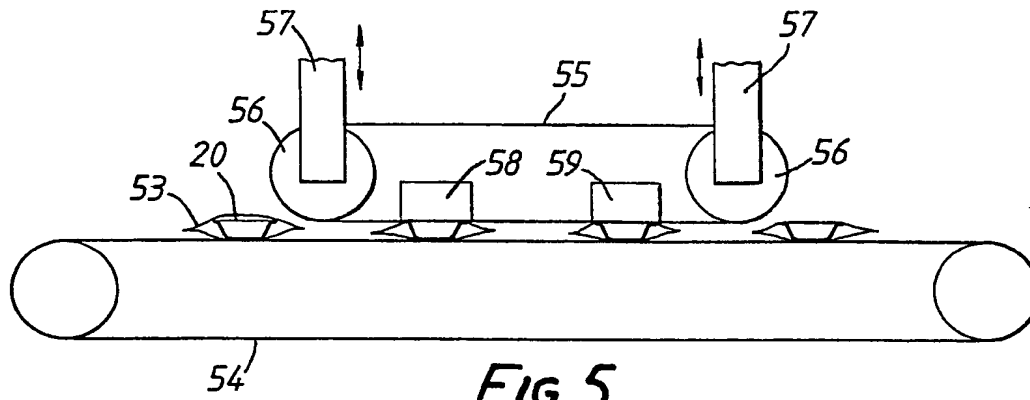


FIG. 2.

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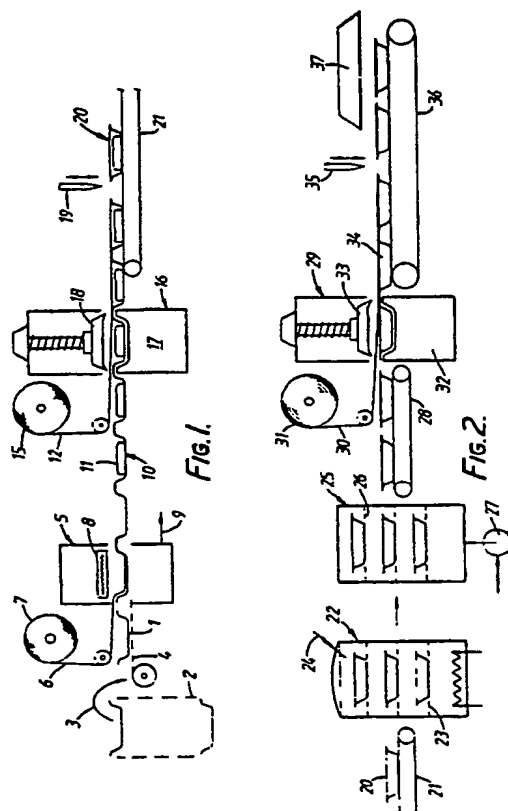
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Improvements in or relating to packaging.

A process is disclosed for packaging a food product in a container (1) formed of or lined with a heat-resistant thermoplastics. The container is closed by sealing to the container a lidding material (12) which is permeable to water and gas but impermeable to bacteria, such as so-called "medical paper". The food product can then be sterilized or pasteurised by heat-treatment and the lidding material is then covered by a barrier layer which is impermeable to moisture or permits controlled moisture permeability. The lidding material and barrier material are applied by heat-sealing techniques and the final package may be irradiated to sterilize the head space between the lidding and barrier layers.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 87 30 8377

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|--|---|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl. 4) |
| Y | DE-A-2 753 177 (BOSCH) * Whole document * --- | 1,3,4,6 -8 | B 65 B 7/16 B 65 B 55/14 |
| Y | US-A-3 435 948 (KAGANOV et al.) * Column 1, lines 46-48; column 4, lines 27-29; figure 3 * --- | 1,3,4,6 -8 | |
| A | EP-A-0 127 466 (DAINIPPON INSATSU) * Page 1, lines 32-35; page 2, lines 10-14; page 5, line 27 - page 6, line 4; page 7, lines 7-20; page 8, lines 6-13; figures 1,2 * --- | 1,2,7,8 | |
| A | GB-A-2 115 770 (TRANSPARENT PAPER) * Page 2, lines 34-42; figure II * --- | 7 | |
| A | US-A-3 843 806 (KISHPAUGH et al.) * Abstract; figure 2 * --- | 1,7 | |
| A | DE-A-2 539 351 (HARRIS) * Page 5, last paragraph - page 6, paragraph 2; figures 4a,4b * --- | 1,3,4,7 ,8 | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |
| A | CH-A- 494 677 (KAUPERT) * Column 3, line 55 - column 4, line 6; figures 5,6 * ----- | 9 | B 65 B B 65 D |
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| Place of search THE HAGUE | | Date of completion of the search 19-12-1988 | Examiner SCHELLE, J. |
| CATEGORY OF CITED DOCUMENTS | | | |
| X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document | | T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document | |

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